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Development of synthetic flood damage curve by explicit costs analysis

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Damage modelling is a key component in flood risk assessments. A conventional approach for estimating direct flood damages is the use of depth-damage functions. However, at present, there are few studies that describe in detail the parameters involved in the models and the hypotheses used for the development of these functions based on synthetic approaches and/or actual flood damage data.
In this work a synthetic approach was adopted for the development of a damage model for residential buildings. The approach follows the loss assessment procedure usually applied by the insurance loss adjusters. Required information consisted of all those variables that are necessary to define hazard characteristics at building location, compute the exposure value of the building and the replacement costs of its components. In detail, the model requires four input tables. The hazard module includes the variables describing the features of the flood event at building location (e.g. water depth outside the building, water depth inside the basement, maximum velocity of the flood, duration of the event, contaminant and sediment load). The exposure module includes both extensive variables (e.g. foot print area, number of floors) and "vulnerability" variables, where the latter affect damage estimation in two different ways: by changing the replacement value/unit prices of the building and its components (e.g. the finishing level, building type) or by modifying the function(s) describing damage mechanisms (e.g. building structure, plant distribution). The replacement values table and the unit-price table include respectively the replacement value of the building and the unitary replacement costs of the different building components (e.g. doors and pavement replacement per square meter). The final output of the model is represented by different sets of damage functions describing all the building components (e.g. plasters, plants), depending on hazard, exposure and vulnerability characteristics. Such functions were developed using a what-if analysis using data collected after the 2012 flood in the Umbria Region in Central Italy, as well as authors' experience, as reference to understand damage mechanisms. Observed damage data were also used to calibrate the functions.